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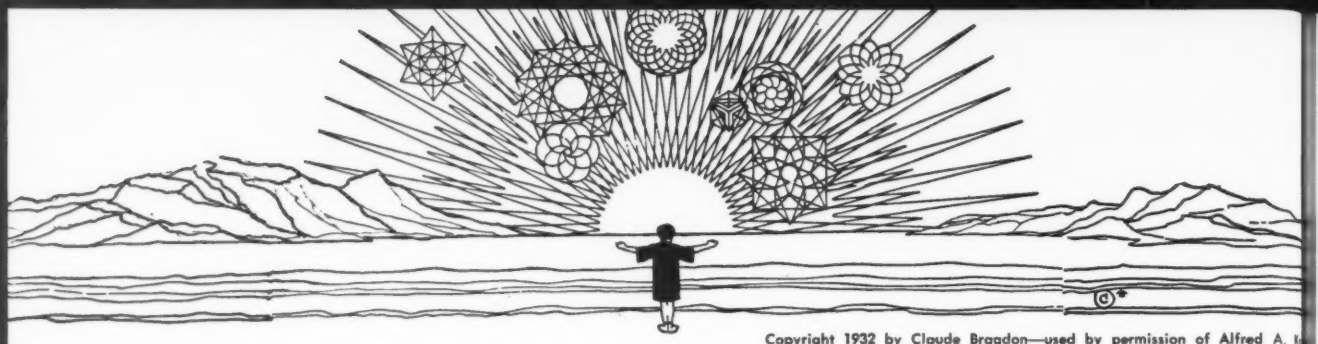

MAIN CURRENTS
IN MODERN THOUGHT

A cooperative journal to promote the free association of those working toward the integration of all knowledge through the study of the whole of things Nature, Man, and Society, assuming the universe to be one, dependable, intelligible, harmonious.

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THE ENIGMA OF HUMAN NATURE*

Gardner Murphy

The Menninger Foundation

Some New Dimensions Which Enlarge Our Study of Man

THERE are three familiar questions in which we are wont to frame our ignorance of human nature. The first is, Where does man come from? Second, How does he reflect or mirror the universe of which he is a part? And third, what are the boundaries that separate a man from the world?

Our lack of any ready answers to these questions, or indeed of any real knowledge about man, may be exemplified by something which James Harvey Robinson said while he was working on what he called "the history of the human mind," portions of which were published in his fine book, *Mind in the Making*. Robinson described the confidence with which eighteenth-century man contemplated his own position. For instance, in the *Decline and Fall of the Roman Empire*, Gibbon said that, after millennia of confusion, man had at last settled down to rationality, freed from violence and disorder, and that he could clearly and quietly plan in peace. This statement, of course, was made by Gibbon just before the outbreak of the French and American Revolutions.

Then Robinson went on to discuss a latter-day point of view, expressed by H. G. Wells in his *Outline of History*, (1920) which might called the attitude of the nineteen-twenties. His position was that man at last was able to command the whole sweep of cosmic evolution. Through the contributions of Laplace and others, the derivation of the planetary system and indeed the whole history of the cosmos lay open to view. And of course, following Darwinian theories of the proliferation of life on this planet, it could be clearly shown that man, in close affinity to the other primates, reflected the basic problems which living creatures always present. In the same way, Robinson pointed out, we had, by the nineteen-twenties, learned to understand the principles of literary criticism and, above all, Biblical criticism, so that "Revelation" need appear no more as a stumbling block in the way of rationality. Again, through the attainment of an understanding of economic and political life, and the amazing development of cultural anthropology, we were able, according to Robnson, to see man as he really is.

It seems hard to believe that only slightly more than thirty years have passed since this quiet confidence about man was formulated, only to be thrown into confusion by the following generation. How little of what Robinson taught us in the early twenties can we say as confidently today. How little that Gibbon knew so surely can be certain for us of the nineteen-fifties. We seem to be facing a pace in discovery so great that it scarcely permits any assimilation. We have to un-learn so much that we knew about man that we wonder if we shall have the strength and the time and the skills for a fresh attack.

THE problem might be stated in this way: What are the implications of the new dimensions in which we now study man? Suppose we ask a simple question, such as: what is *inside* man? For even a basic physiological study, the field of inquiry has changed to an extraordinary degree. In his *Politics*, Aristotole says, "Most things are known. The problem is to apply what we know." Today we must realize that before we can say we know anything about what is inside man we must have at our command lens and microscope, both unknown to Aristotle, which open up to us infinitely complex cellular and atomic structures of which neither he nor the men of the eighteenth century had any suspicion.

Can we assume, from the strides recently made in knowledge, that we are getting into a period of diminishing returns, so that within a few more years we can say with justified confidence that we know what is inside man? Unfortunately, if we look at the problem from another point of view, the functional, it becomes more and more complex. It is only a little over a half-century since Sigmund Freud developed his conception of the unconscious and so began to carry forward some of the great insights of the ancient world about the nature of consciousness. His contribution gave a new dimension to our problem, by sug-

*Colloquium address at the May, 1956 meeting of the American Unitarian Association, in the First Church, Boston, Mass.

gesting that a large part of what is inside man he cannot know, because he fears to know.

We now begin to glimpse the question in terms of a panorama that is far greater than our own present ability to view it. The whole vast realm which constitutes the dynamics of the human unconscious—including motivation, conflict, symbolization, the schema of what man is and what he aspires to be—is opening out before us. It is such a tremendous vista, and extends so far beyond the limitations of present knowledge, that we cannot help looking back upon those past generations who felt so securely that they *knew*, as quaint and naive, if not pathetic.

But there are still other dimensions to this problem of man. Through tracer techniques of radioactive elements, we are beginning to study, not only content-wise but also process-wise, the intricate complexities of the chemical realities which underlie life. And we are beginning to glimpse some ways in which the psychological dynamics of the unconscious may be related to the fascinating bio-electric phenomena that go on all the time within the tissues.

In the same way, the time dimension has recently taken on a strange new form. This is partly because the span of life on the earth, and of the earth's existence, has been materially stretched in the last few years. But I am referring here more particularly to the way in which the structure of time has been "filled in." This again has become possible to us through studies of radioactivity. It is possible now to take a Geiger counter to the American Southwest and with it determine quite exactly the age of many a fossil remnant, by a study of the uranium decomposition series, the process by which uranium gradually degenerates into lead. It has also been discovered recently that the same sort of thing can be done for human history with radio-carbon. As a result of these extraordinary developments, it is now possible, for example, to date an event in Central American or European history to within just a few years. It is also possible to supply all sorts of cross-checks, such as the age of peat-bogs or the distribution of pollen, that define the exact period in which a famine or a pestilence occurred.

President White of Mills College has suggested that by these means much of the motivation of past generations can become suddenly clear to us. With a knowledge of psychoanalysis on one hand, and better dating techniques on the other, we can now cross-check some of the unconscious factors about which we could only guess, and that very timidly, even a few years ago. Thus historical man can become vivid for us as we begin to perceive his psychological realities.

SOMETIMES these new dimensions also begin to break down barriers which separate one person from another. As taught two or three generations ago, there was scarcely anything more dogmatic than the concept of the self-sufficiency of the individual man. It was assumed (erroneously, as we now know) that Darwinism required acceptance of a highly egocentric struggle for existence, which implied, in the age of the Industrial Revolution, a high degree of individual competitiveness. This was widely interpreted to mean the war of all against all.

A great deal of work being done today disproves this kind of theorizing from Darwinian premises. Studies of gregarious living at many animal and bird levels, of primary social organization and of more complex societies, have begun to show us new aspects of the so-called law of self-preservation which hitherto had been overlooked.

I can illustrate this point by an example at the human level. My friend, Hans Lukas Teuber of New York University, is making a study of men who have suffered perforating wounds of the brain resulting in permanent brain-tissue losses. A great many of these, nonetheless, are able to handle their lives effectively; they are not psychotics, nor have they lost heavily in intelligence levels. Although they carry around in their bodies the marks of this accident of war, they are eager to understand themselves and others. Faced with the problem of conducting an intimate psychiatric and psychological study of the perforating wound, in terms of our understanding of brain organization and function and of total personality, one would assume that it might be difficult to find two hundred men with this disability who would give their time to the investigation without compensation, and indeed with some financial loss to themselves. In terms of the classical theories of human nature, only some important egocentric motives would induce these men to undergo this considerable hardship and inconvenience. Yet Teuber has found by long experience that the way to get these men is to make it clear to them that they can be of real help to other men who, in a brain-injured state, may ultimately benefit from new knowledge.

The fact that, under such conditions, men lend themselves freely, for the single reason that they want to benefit their fellows, seems to indicate the possibility that we "knew" something about human nature that was not so. The definition of the individual man, encapsulated and sharply divided from his fellows, may well have basically missed the most important point in the human equation.

To take another instance, many people thought that Gandhi was essentially impractical, and that his prescriptions for village industry were unrealistic and contrary to the spirit and tempo of a world geared to large-scale industrial production. Yet one cannot fail to be impressed by the achievements of Vinobe Bhave, the great prophet of Gandhian philosophy, who has proceeded on just the same assumptions that govern the work of Hans Lukas Teuber. It is his simple belief that if one asks in the name of good will, men will respond in that same spirit. Thus he gives the poor Indian peasant, who has perhaps an acre or two of land, the privilege of sharing what he has with those less fortunate. And the poor peasant gives with the greatest generosity. The human heart readily re-

sponds to the opportunity, freely and spontaneously given, to be of help to another.

Instances such as these compel us to reconsider the nineteenth and early twentieth century assumptions about the encapsulated human being. The question involves not only the divisions between persons, which may not be so sharply defined as we sometimes think them, but also the capsule walls between the person and the cosmos as a whole.

The cosmos may be thought of as a "physical system," if so desired, although, in view of the difficulty we now find in making a clear distinction between what is material and what is psychical, or spiritual, I myself am inclined to doubt whether I—or anyone else, for that matter—really knows very much about what these contrasting terms are supposed to convey. But even if we accept the cosmos as a physical system and nothing more, the relationship of man to that system is becoming steadily more fluid. A prophetic statement made by Henri Bergson in *Creative Evolution* could be regarded as a sort of prediction of what has happened. Bergson said that the brain and eye of the man who is watching the farthest nebula form one organic unit with that nebula. In reality there is no such thing as the object stimulating the person and the person being stimulated by the object; one flows to meet the other.

Contemporary physics has widely employed concepts of this kind; more recently, biology and now psychology have been forced to their use through the discovery of such principles as isomorphism—literally, the "presence of identical forms." This means, in effect, that the very form or structure of the cosmos is duplicated in man, in the sense that the wave-motion, or other time-space order, within cosmic structure is duplicated in miniature within the individual. The living organism is a sort of "harmonic," a reduplication of, or resonance with, vaster forces which he can perhaps only hope to know as he sees his own nature expressed more grandly in larger space-time terms.

Just where this passes over from a sober scientific statement of fact into an expression of ecstatic union or mystical belief, I cannot pretend to say. But I would feel fairly confident in stating that the microcosm which is man receives its law or structure from a more general law; that it is repeating, like the sympathetic vibration of a wire, the vaster processes of the macrocosm, and that it is perhaps capable of telling us, through its own inner rhythms, something about the larger rhythms of which it is a replica.

If we could be at once both bold and cautious, we might somehow find that human evolution, considered in terms of past, present and future (quite unlike Bertrand Russell's ideas about man's protest against the universe) is essentially a reiteration of the basic oneness of human development.

There is a good deal of reason to suspect that the nineteenth century's argument was, essentially, that the way we understand a human being is to study his clothing, because by so doing it ought to be possible to find out what kind of a living thing could occupy those clothes. Nineteenth century German and British mechanism was derived to a considerable extent from the theory that life can be understood by comprehending how material forces are organized within the cell. Today the position is almost completely reversed, for it now looks much more as though the process of cell organization, which is itself attuned to cosmic organization, determines to a considerable extent how the matter is to be used.

In case this seems a mystical view, I might remind you that serious-minded physicists and biologists are expressing just this concept. To illustrate, I might cite the remarkable papers written by Spemann, the embryologist, and von Bertalanffy, the biologist, who are responsible respectively for what is known as Field-theory in Embryology and the Theory of the Open System.

Spemann, and his pupil Paul Weiss, held the view that it is not very fruitful to study the laws exemplified in embryology through the separate bio-electric processes, such as ionization; that the way to understand these particular physical processes is rather by seeing what the cell, or even the whole body, is doing. They were able to show that the development of foetal life can be best understood by assuming that the maternal and foetal bodies are in some respects a single unit. That is to say, there is a reciprocity so intimate that it is more realistic and more accurate to treat the living system-of-two, rather than one-plus-one individuals. A further study of the separate organ systems within the embryo showed that the regions in which the foetal eye or ear develop, for example, are constantly being impressed by life forces as wholes. Thus if a group of undifferentiated cells, which could become almost anything, is planted in the eye-region of the embryo, they will turn into eye tissue; if they are planted in the ear-region, they become ear tissue. The phenomenon would almost smack of the miraculous were it not a demonstration that the laws are constant, from the larger aggregate to the more particular.

NOW is this, other than verbally, dissimilar from the proposition that cosmic structure determines, in considerable measure, the nature of organic structure? Or is it very different from the thesis I have been groping to express, that the nature of man may be seen more and more intimately as a replica of larger forces? Therefore, if we are intellectually honest, we will seek the clue to cosmic forces in a fuller understanding of the way in which this duplication is effected. Since we know more about ourselves, in some respects, than about spiral nebulae, it is possible that we may gain some conception of cosmic structure by assuming that the large and the small partake of the same basic order.

If this is true, it would also seem to suggest that in our response to one another there is more than social reciprocity involved. To this point von Bertalanffy contributes his principle of the open system,

which may be briefly stated as follows: Given the ordinary exchanges of energy, the tendency of the universe is to run down. The principle of entropy suggests that there is ultimately a degradation of energy into the form of heat, with a final levelling process, or condition of maximum entropy, in which the universe would consist of nothing but an even, dead distribution of heat-energy, at a temperature not much above absolute zero. But according to von Bertalanffy, this concept is basiclly alien to the point of view of the biologist, who has to regard a living system as capable of producing and growing within itself forces which *increase* the amount of organization. As Bergson maintained fifty years earlier, this is a creative process, but now, on the basis of more detailed and accurate information, the idea can be carried further, to show that this creative activity is the very nature of the primitive life-process itself. The concept of the open system really means that living things are not only intent on their own growth and development, but that they are directing evolutionary processes in accordance with a dynamic which is organismic, rather than mechanical.

Another contribution has been made to this overall organismic view, this time from the area of psychology. Kurt Lewin, the founder of field-theory in psychology, did some brilliant studies of what he called Group Dynamics. Lewin's work showed that there are all sorts of social processes which can be understood much better by grasping the dynamics of the whole, and then working towards the individual, than by proceeding the other way around. One of his many experiments, which had to do with the way in which housewives might make their contribution to the war-effort, will serve as illustration.

The problem was to persuade housewives in wartime to serve their families various unpopular cuts of meat, to replace the scarcer items. Lewin found that it was relatively easy for an expert nutritionist to convince the housewives that the cuts could be prepared palatably, and a public-opinion poll showed that the women agreed they would try them. However, another poll, taken two weeks later, showed that they had *not* done so.

Nevertheless, there was another method which could be tried. This time the nutritionist acted as a "resource person." She did not deliver a persuasive lecture, but instead asked the housewives to discuss among themselves what they would like to do. In their discussion, they freely and spontaneously determined upon certain innovations, and thus a group commitment was made. Another poll, taken two weeks later, showed that many of the women were really carrying out the studies upon which the group agreement had been made.

All these experiments—of Lewin and Hans Lukas Teuber and Vinobe Bhave—seem to suggest that in some yet unexplained fashion man is more completely himself when he is not completely himself, when he has in part lost his personal identity within a larger whole. I do not myself know how much poetry or mysticism and how much science are contained in this idea. I merely want to present the problem, which needs to be wrestled with honestly and without prejudice, for no possible conclusion can be reached until we have perceived some of the subtleties and difficulties which are involved.

IT is obvious that this point leads directly into the area of religious experience. If we study the cases given in Bucke's *Cosmic Consciousness*, we find that they are studies of a few dozen men and women, scattered throughout history and through many cultures, who have all had similar experiences. Although they described it variously, they all testified that the experience was greatly beyond the "I." Yet when the person "came to himself" again, returned, as it were, to his encapsulated individuality, there continued to remain for him the possibility of a kind of hook-up with the tremendous experience, an increased interest or awareness in something beyond himself.

The people who have had these de-personalized experiences are not particularly rare. From casual inquiry, I think that at least three or four out of each hundred modern American men and women have had experiences of this sort, at least on a small scale. What does this imply? At the least, I think, as William James has said, that consciousness is not limited to that personal variety with which psychology is ordinarily concerned. There may well be an infinite variety of modes of consciousness, of which self-awareness is only one. These experiences may range from the most sublime to the most chaotic. At one extreme there are people like Plotinus, with his tremendous vision of the One, and at the other the most pathetic, disoriented schizophrenics, who are hardly capable of maintaining human existence, much less claiming a perennial vision.

The question at issue is whether these experiences can throw some light on the basic problem which we raised initially, namely, whether there is a sharp boundary between individuals, and between the individual and the cosmos, or the whole. I would agree that the problem of a bio-chemical boundary is very different from the problem of the boundary of the self. In fact, the latter may be nothing more than a convenient device, whereby it is possible for us to be aware only of those aspects of our own individuality which are needful to us at a given time. It might also be true that we are constantly in a sort of throbbing interchange with unknown aspects of ourselves, with other human beings, and with various cosmic processes, which we lack the subtlety to understand or the language to describe. We must keep our minds open as regards the meaning of these de-personalized experiences whatever they be called—mystical, psychical or paranoid. Perhaps, as James suggested in his chapter on "Religion and Neurology," in *The Varieties of Religious Experience*, classifying these experiences in terms of sanity and insanity will get us nowhere. It is possible that value-judgments regarding human aspirations are independent of medical judgments as to problems of pathology, although this seems rather far to go.

N all this discussion it will be perceived that I have been attempting to throw together a number of lines f thought which would suggest very tentative answers o the three questions which have been raised. To re-erate these, the first concerns human origins, and n this connection I have suggested that these origins o not stop with guesses as to how life began on this lanet, but involve larger questions of the nature of smic structure. I have intimated that these problems ight be basically the same, except in scale. This has ed us on to the second question, which concerns the ature of human consciousness, and here I have tried o show that there is a sort of mirror within the ndividual, by which he might be able to see himself n the light of cosmic structure, and cosmic structure n the light of his own being. Third and finally, in con-idering the boundaries that separate us as individuals e from the other, and as humans, from the cosmos, he suggestion has been that these are often less sharp han we imagine.

If we pursued this problem further, we might con-eivably arrive at some such point as the poet William Watson defined in his paradoxical phrase:

"Magnificent, out of the dust we came;
And abject, from the spheres."

It might turn out that there are two origins of nan: one related to what we would ordinarily call naterial structure, and another, of different origin. However, most contemporary thought suggests that what we are concerned with is a unitary rather than a ual structure; that it is probably matter *and* spirit, ather than matter versus spirit, cosmos and human, ather than cosmos versus human.

But I would not have the arrogance to talk to you n such a topic as this if I felt that the answers were isp and clear and easily identified. Rather, I think hat the search for these answers will engage our chil-ren, and theirs, and perhaps on through the life and ork of still other, following generations. Of these sily challenged areas of human knowledge, we never, uite know, when we get off onto some lunatic fringe, hen we may suddenly find ourselves emerging into e full-fledged higher lunacy. We almost never have e full assurance that we are not treading on that hich is too alien to common sense to be covered with quanimity.

My own feeling is that a very large part of what is ue is ridiculous. The very nature of human discov-y has become so standardized, so easily available, at the true is often considered to be that which can e readily tested by the crudest and simplest tech-ques. Yet there are lines of investigation which etch out, into, and around the data of empirical owledge, and which challenge the good faith and od sense of our every-day assumptions.

While I do not want to give major emphasis to is point, I would like to illustrate it from the field psychical research, or parapsychology, whose evi-nce, I believe, reinforces and confirms much that have already discussed.

In recent issue of *Science,* published by the Ameri-can Association for the Advancement of Science, Dr. George Price made the point that it is impossible to talk sanely and reasonably about events which are not ordered in terms of matter, time, energy, space, and the other basic concepts of physics. The great objec-tion to the experiments in parapsychology is that we seem to be dealing with events which literally trans-cend space. For instance, the recent book by S. G. Soal and F. Bateman, *Modern Experiments in Telepathy,* published by the Yale University Press in 1954, repre-sents about a dozen years of faithful planning, experi-mentation, and working-up of data which indicate the capacity of some individuals to catch and record impressions of pictures being observed by other per-sons, under conditions clearly precluding the ordin-ary spatial interpretations. In these experiments, the sender and the receiver are not only in different rooms; there is one extensive series of high scores in which they are on opposite sides of the English Chan-nel. The studies have been elaborately safeguarded, with A watching B and C watching D, and a system of cross-checks which precluded even a group of three or four people from faking a result, because half a doz-en others would also have had to be in on the trick. This book is a good example of the kind of tightly-con-trolled experimental research now available in the field of parapsychology.

If this kind of study indicates a trans-spatial recip-rocity, then it requires a much greater extension of the idea that there are no sharp boundaries of the human individuality. For example, Soal has reported some extraordinary data, known as divided agency. In this experiment, two persons, A and B, working independently, transmit material to a third person, C. Neither A nor B knows the whole story. A may know where a certain picture lies, but not what it is, whereas B knows what the picture is, but not where it lies. In order to record, C must have some access to the minds of both A and B, in order to know where to look, and then what to see. Yet C can do this to some de-gree.

Some of the Soal data likewise indicate a capacity to indicate material which will be randomly chosen at a point in the future, which appears to suggest a trans-temporal, as well as a trans-spatial, mode of function. To carry forward the idea of the person as no longer sharply encapsulated, I should like to offer a third term which I prefer: "trans-personal." This implies the frame of reference which closely defines a particular individual as being in just this particular place and time may be inappropriate as a way of describing some human reality.

To conclude, I am basically asking a great deal of you. I want you to double your doubts, to ask your-selves what you really know, to challenge even those most confident liberal and humane beliefs which most of us in 1956 are sure we have a right to entertain. Finally, I want to persuade you to look forward cheer-fully to a very long period of frustrating uncertainty as to the meaning of this great enigma, which is hu-man nature.

SPACE-TIME SPUN OUT*

Winifred Duncan

A Consideration of the Spider's Web as Possible Evidence of a Bio-physical Field

MAN is actively related to his environment, not only in terms of his internal and organic nature, but also by means of his artifacts. His tools, houses, garments, vehicles, and the like, are ever-improving differentials that accommodate the pace and properties of his psycho-somatic system, and that of his society, to his environment. An igloo is the result both of an Eskimo's ideas about nature, and of the actual properties of snow, arctic winds, and temperature. So also, a house in Keokuk, Iowa, is a form in which man and nature are, morphologically, jointly expressed.

II

DURING the dominance of the 19th century philosophy of science, artifacts were interpreted as functions of a mechanistically conceived nature that has evolved a mechanico-chemical mankind. But we are now able to recognize, in many of our most indispensable devices, the over-riding coercion of those field forces which are coming to be accepted, in physics, as dominants in nature. The wheelbarrow is not only a mechanism. It is, in part, a functional embodiment of the gravitational field. This dual expression of mechanics and fields is more easily seen in the catenary curve of the main cables of a suspension bridge, which actually records one of the lines of force peculiar to gravitational fields, as do the parabolic projectories of a ball or a bullet.

Brooklyn Bridge, built in a mechanistic era, was conceived upon purely mechanical principles, but gravity as a force field was at work all the same, and had to be obeyed.

For our present purposes it is important to be clear on this point: ignorance of field aspects of the design does not relieve an artisan from the necessity of obeying field laws where these apply. Indeed, man's ignorance of the law is less of an excuse before the bar of nature than in man's courts of law, for in nature judgment upon ignorance is immediate and final: the device doesn't work. At the human level, however, the complexity of the process is so great that man may violate a law, such as a principle of diet, for some considerable time—even, indeed, for most of his life—without having the laws catch up with him in a clearly defined sense. We have been ignorant of field forces until recently, but that has not prevented them from working.

III

SINCE about 1875, artifacts have been appearing which explicitly express field properties. The windings and general design of an electric motor constitute a model of some of the geometric properties of an electro-magnetic field. True, it is also a model which embodies man's concepts of the nature of electricity, but it *works* because the concept and the field structure correspond fairly exactly. The motor, of course, does mechanical work also, but its chief meaning, as an artifact, is that it provides a place where the construct in a human mind (originally, that of James Clerk Maxwell) and the non-material structure of the force field itself, meet and fit, part for part.

IV

THE term, field of force or, in the proper context, merely field, will be used herein to refer to the non-material structure, real space (or in some cases, space-time) which not only surrounds but interpenetrates an object and affects both its structure and its behavior.

Two fields have been established by mathematical and physical inquiry, namely, the gravitational field and the electromagnetic. Up to date they continue to resist all attempts to combine them into a single, unified, provable theory. Since they have coercive effects upon objects, and can be used to do work, they are said to be force fields. They are both quite familiar to experience, though imperceptible to any sense organ. The magnetic aspect of the electromag-

*F. L. Kunz has provided the outline of this article.

netic field has been under observation in Europe for several centures (Gilbert's book *De Magnete* is dated 1600 A.D.); as for the gravitational field, it has been experienced ever since physical man came into existence. But we have only lately begun to understand them on their own terms.*

The relation of the internal structuring of material objects, such as crystals, to non-material, interpenetrating fields, is being gradually explicated. Already the account of the exquisite refinements of electronic orbits is being extended into the atomic nucleus, where another elegant but far more powerful and minutely devised system seems to obtain. Matter, more and more, is coming to be seen as a function of space or space-time properties, and certain general considerations suggest that the field may be causal and that the kind of matter we perceive may be derivative and secondary to another kind, namely, point charges in the field.

V

LIVING creatures are made out of matter and employ energy, and of necessity, the two known fields are operating through and upon them. But their structure, properties and behavior are not describable merely in terms of physics. They have unique aspects. The question naturally arises whether plants and animals may not, therefore, be living in and dealing with a third type of field. Their higher orders display remarkable internal electromagnetic gradients, which may properly be regarded as unique, since they vanish at death. Hence they are not accompaniments of matter alone, but are instead functions of living organization.

The electromagnetic gradients in organisms do not by themselves constitute a demonstration of a third, or vital, force field, for it is uncertain whether organization causes gradients, or whether the gradients effect organization. If the latter, the question is, how do the gradients come into play as the organism develops.

This does not mean that there is no evidence whatever of the existence of a vital or psycho-somatic field. For example, if the evidence for telepathy proves valid, it may be considered as suggesting such a field, for it operates through space (and through time, in certain cases) in a manner not governed by gravitational or electromagnetic principles. In the latter cases, the energy involved, or the field strength, when measured at varying distances from the source or center, diminishes by what is called the inverse square law. As this is not the case with telepathy, it cannot be either a gravitational or electromagnetic field phenomenon, which suggests the possible existence of a psycho-somatic field.

*The electromagnetic field was described mathematically only around 1875, although experimentally, in a partial way, it had been demonstrated earlier by Faraday and others. Isaac Newton provided the theory (i.e. the mathematics) of gravity in mechanistic terms. It was Einstein who carried the description further by providing a space-time structure.

For the sake of those who reject out of hand the idea of a third, or vital, field, let us recall that we have had evidence of the gravitational field ever since children began to fall down, and adults to throw things at each other. Yet the fact that a missile's trajectory is a field effect was proven only in this century. There may be hundreds of bits of evidence of a life force field which continue to appeal to us in vain. The entire morphological spectrum of living things may be just as much evidence of such a field as the electromagnetic spectrum, or that of visible light, or the vast range of sub-atomic, atomic, molecular and crystallographic forms which constitute evidence of the reality of the electromagnetic field.

Plant and animal morphology constitutes the most hopeful and abundant evidence for field forces at work in ways peculiar to protoplasm, cells and bio-organization, and a major endeavor to systematize the geometry of plants and animals is long overdue.**

VI

OUR present purpose is indeed quite modest. Putting aside for the moment the taxonomy of plant and animal morphology, we propose to point to the possibilities that lie in an inquiry into one of the devices of living creatures whose functions are similar to the artifacts of man. The oriole's nest, the beaver's dam, the bee's astonishing wax-works are also devices which adjust the nature of the creature to its environment. To be sure, they are not constantly improved upon, as are man's devices. Since there is no conscious invention or interchange of information in nature, established patterns of various species are even more significant, as a mirror of the permanent and immediate workings of the creature with its environment. As they are at once both artifacts and non-artifacts, they may serve as clues to the biological field.

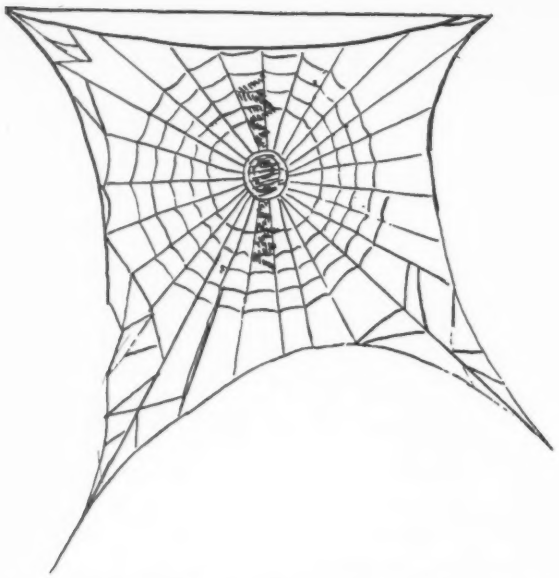
In order to work with examples having measurable and relatively simple geometry, we might start with the spider's web. The proposed inquiry is to analyze the web as the visible field of the spider's morphological life-expression, its self-extension into space.

Let us take the highest development of web-structure, which is the geometric orb, between which and the other four types of web construction there is as deep a gulf as between the simple sand-burrow of a beach flea and the complicated labyrinth of a wood-boring beetle. As an example we shall choose the so-called "garden spider," Argiope aurentia, black and gold, with a body length of about one-half inch when adult.

VII

HAVING found a suitable space, Argiope will proceed to suspend in it a design which will be geometric, barring outside accidents. She will construct first a framework of cables, the stresses and strains of which will be adjusted to the given space as carefully

**This need has been described in MAIN CURRENTS, Vol. VIII, No. 1.



Orb web of the Argiope, Miranda durantia, showing camouflage in center.

and accurately as those of a suspension bridge. Within and upon this she will lay a circle of spokes radiating out from an established center and connected at their widest angles by enclosing lines which roughly form a circle. Upon this wheel she will lay down, at center, a tiny spiral of Archimedes of three or four turns, which she will later fill in solid with a white flat mat of silk to stand upon. Between this and the wide spiral* she will leave an empty space with only the spokes running across it. The wide spiral will be carried deep down to the limits of the framework. The angles of the radii and the distance between spirals will, if she is unmolested, always be at identical distances apart.

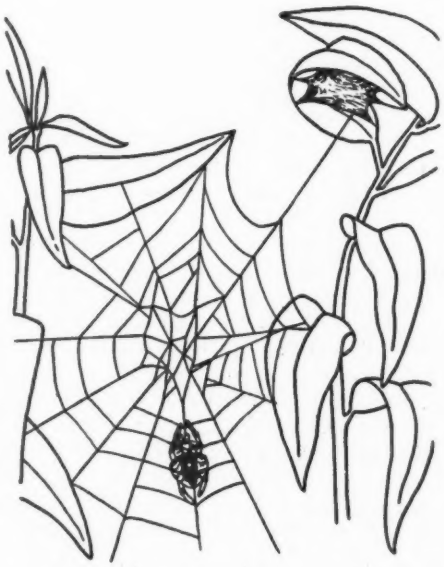
Every order, and very often every species, of orb spider will make this fundamental construction but will vary it in many ways, each set of variations being characteristic of the entire species. What will not vary, however, is the mathematical design of the aforesaid angle of the radii and the distance apart of the spiral turns.

In the case of Argiope, having completed the orb and returned to center, she will make a mat and then extend, on the radius which drops directly below center, a thick, white zig-zag embroidery of silk, the special distinguishing characteristic of her orbs, which no other spider repeats. Its purpose is to confuse the eyes of birds and wasps (a spider's worst enemies) and take their attention off her own body, at center.

Now this circular, or—if the space is narrow but deep—oval orb web is actually made of straight lines. Spider knows nothing of curves. Neither can she see, at any time, what she is doing. Her eight eyes are of no use to her in constructing the orb because the silk comes from her spinnarets, which are out of her sight at the extreme rear of her abdomen, and is pulled out and attached, in short lengths, entirely by her hind legs and by dipping her abdomen to the desired attachment. In short, the whole construct is made behind her, by the sense of touch. Therefore, an exact commitment to the design, *before* it is made, must be assumed. The whole construction takes about forty-five minutes, and barring outside interruptions she works steadily, rapidly and unhesitatingly from beginning to end. No invariable electromagnetic field is there to guide her, yet all individuals of her species will, in ideal circumstances, make precisely similar orbs. Any variations which occur are due either to the amount of space available, or to the amount of silk at her command at the moment. So light is this silk that the pull of a gravitational field hardly applies, except in relation to her own body, and this she handles through various slight shiftings of posture as she works.

Now Argiope is a bilateral animal. In the whole construction of the web she has been progressing forward in straight lines. Yet she has created for herself a field of radial symmetry, in the center of which she will now take on the attributes of a radially symmetrical animal.

Adjusting her eight legs in a circle, planted on eight of the many radii, she is instantly conscious of vibration at any point on the perimeter of the orb,



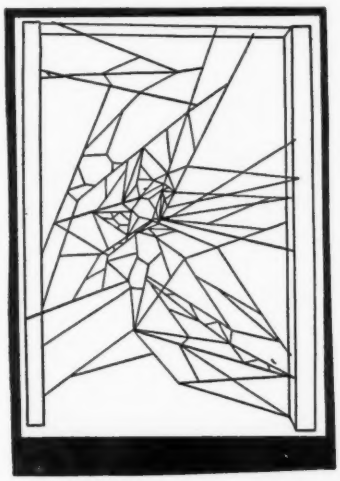
A spider disturbed while weaving makes a wild inner spiral.

*Reference is to the sticky spiral, not to the preliminary smooth spiral, which is first constructed as a support and afterward removed, and which is frequently much wider in its revolutions.

whether to either side or behind or in front, and, if the vibration is caused by a trapped moth or fly, she will pivot her body and make straight for it. If the prey is too large and strong to be stung immediately in the cervical ganglia, she will not even attempt to wrap it in silk until its struggles have partly enmeshed it in the web. If small, she will dash at it immediately, and she often judges this difference in size from vibration, without leaving the center. The web is her tuning fork, her telephone, her radar. When frightened, her method of defence is to clutch the eight radii on which her feet lie, and by rocking her body violently in and out and bending and relaxing her eight-knee joints, so that the whole web shakes and trembles, she warns intruders to get out. Only in extremity will she abandon the web and drop, head down, on a line to the ground, where she will play dead until she is safe again, and then climb back, "hand over hand," so to speak, to center. She can distinguish instantly the vibration of a caught insect from that caused by a sudden gust of wind, and will pay no attention to the latter. If a wandering male spider enters the web by accident and not at mating time, she will instantly chase it out. If a male Argiope enters and begins his mating dance (which is a complicated vibration of the web due to his own special set of acrobatics), she watches him intently, turning about in the center with little hops so as to keep him always in view.

Thus the entire orb is an extension of the Argiope consciousness into space. It serves five major requirements: 1. Shelter against an unknown and, to her, random environment; 2. (all-important) Her food trap; 3. Her mating platform; 4. (in other orders, not in Argiope) A scaffolding for the suspension of cocoons; 5. Shelter and support for the newly born. (But it happens that Argiope leaves the orb and spins and hangs her cocoons under near-by leaves—an exception to the general rule observed by several other orders and genera of orb weavers.)

What, however, happens if, during this geometric trance of building a perfect design in space, an orb spider is frightened or interrupted? She may lose her head completely. There is one large Latin-American spider which drops a huge orb from the low limbs of trees to the depth of two or more feet, with cables reaching to the ground four feet below. If even so much as looked at steadily in the light of a torch, this spider will literally go into a tantrum. She will reach out one long leg and with a swipe will reduce the whole web to a limp, collapsed rag, which she will trail behind her as she dashes up a cable to her leaf-shelter above, like an angry dowager swishing her train. This is unusual. The average orb-weaver in the process of making her large spiral will, if disturbed, dash for center, or out a radius to the rim of the web. When all is quiet she will return, but will very likely be unable to find the spot where she left off spinning, so that after pawing about vaguely she will begin another spiral further up the spokes, leaving an empty space which should not be there. An orb spider on a bridge, whose web suddenly filled with a dozen or more tender moths (attracted into it at night by an observer's light), went slightly insane. She wrapped up two of the moths and dragged them to center, dashed about among the others, gave it up, returned to spinning, but made wild, zig-zag lines in the space which should have remained empty, and never, during the hour under observation, returned to her empty spiral. Her chain reactions had been too deeply disturbed, and the invisible field in space which she had traced out again and again had ceased to function as part of her. But on the following night, when wind or insects had destroyed the remnants of her work, she would, barring accidents or interference, again construct a perfect orb, and the pecularities which distinguished it from other orbs of differing species would be once more repeated.



Mesh Web of Theridion tepidariorum.

VIII

THE orb is thus a morphological projection, out into space, of the spider's total organism, of its life —the term life being here used in the sense of its inner psycho-somatic working in connection with its environment, just as an artifact is evidence of the extension of the human psyche into the field of operation.

In the animal, for lack of a better term this connectivity has been called instinct, but the modern biologist is still quite unable to answer the question as to why genetic inheritance, which plays exclusively, as far as is known, upon anatomical and morphological factors, should be given the credit for psycho-somatic activities, even though inheritable. The behavior of the spider in relation to its web is obviously governed by an invisible field, *once the web is under way*. Certainly the physical situation for cable-anchorage can be attributed to that fringe of experience which every animal is forced to accumulate when mere chain reactions fail to meet a situation. If the spider's web is to fulfill its purpose, an adequate space must be

found for its suspension in a confusing maze of foliage, and the attachment on all sides to projecting leaves or wood will vary with every location. The accomplishment of this task requires decision, and often takes the spider on journeys into the unknown which it will never perform again. The cables of some species span five feet of empty space, and are definitely placed, by various methods. The theory that the spider simply emits all these threads and waits for the wind to place them is totally contrary to observation, because the cables are carefully placed in relation to the eventual tension necessary for the radii and the spirals, regardless of the direction in which the wind is blowing.

Just where semi-conscious adaptation ends and autonomism begins in this response to the materialization of an invisible and pre-ordained pattern, is a subject for future investigation. Not only do no two orders of spiders spin identical orbs, they do not even place them in space identically. Argiope suspends her web vertically and rather high up. The Uluberidae place their orbs horizontal to the earth, rather low down in stiff or dead bushes which will hold the web firm. Leucage venusta builds very low, in garden borders or among stiff grasses, and slants her orb at an angle, like the tilt of a sail in the wind. Nephila clavipus builds high up, suspending her orb from tree branches when possible, vertically, as with Argiope.

With the exception of Nephila clavipus, which makes a huge orb with a very fine spiral and narrow radii, the big orb spiders are apt to make untidy webs which do not fulfill the ideal dimensions. The spokes are wide apart and few in number, the spiral often turning on itself and running the other way at intervals, frequently much deeper below than above, thus forming a long, hanging oval. It is noteworthy and significant that it is the very small spiders, with body measurements of one-eighth or one-sixteenth of an inch, which spin the round and perfect orbs. They appear to have a greater degree of control over the field which directs their movements. These perfect, symmetrical webs may on occasion have a diameter of eight or ten inches, made by a four millimeter spider, in whose tiny body it does not seem possible to have accumulated so much silk at one time. Often, however, such orbs will measure only one inch in diameter, with a spiral so fine that to the naked eye it looks like a solid mirror. Such orbs are almost invariably perfect in detail.

The spider's adjustment of her legs in a circle at the center of her web, to receive vibrations, is by no means invariable. Spiders with long, narrow stick-like abdomens remain bilateral, once their radially symmetrical orb is completed. Both Tetragnatha and Uloborus emphasize the bilateral theme by clamping the two first pairs of legs tight together, stuck out in front of them along a spoke, the shorter third pair close to the body, and the last pair stretched out behind, to resemble an inanimate stick as closely as possible. Uluborus buries herself along a line of camouflage, less conspicuous than that of Argiope, but notched with lumps of grey-white silk exactly the shape and color and size of her own abdomen. When inserted among these she is practically invisible.

Obviously there is measurable evidence in the spider web that its structure is in direct relation to individual habits and needs. But these habits and needs do not coincide in all orders, by any means. The trap-door spider simply lines a tunnel in the ground with silk; the Agelinidae merely weave filmy sheets across convenient angles, some genera pulling them up by means of cables into a dome under which they hide, others drawing them down from beneath into a hammock. The mesh web spiders, such as the Pholcidae, suspend an open mesh of loose lines joined in triangles, from a convenient support. None of these forms indicate any logical transition to the marvelous and beautiful geometric orb web.

But although many species of orb weavers live, mate and die in the orb, many do not and are by no means hypnotized by their geometric surroundings. Some species are day spiders and some night spiders, and many, though not all, construct small hide-outs above the orb, silk thimbles upside down, or merely a few threads hidden in cracks, in which they retire to rest. But invariably these hide-outs will be connected with the orb by a single radius or cable, on which spider can rest one foot, so that the vibrations will notify her if prey flies into the orb. From this retreat they will emerge, for the day's or night's work of repairing or re-building the web, at certain set times which can be checked with a watch and do not vary, unless heavy rain or wind prevent. Thus the entire life-rhythm is provided for to the last detail, and its time-response as well as its space-response is exact to within inches and minutes. The time-response is governed by light and dark; the space-response entirely by the sense of touch.

IX

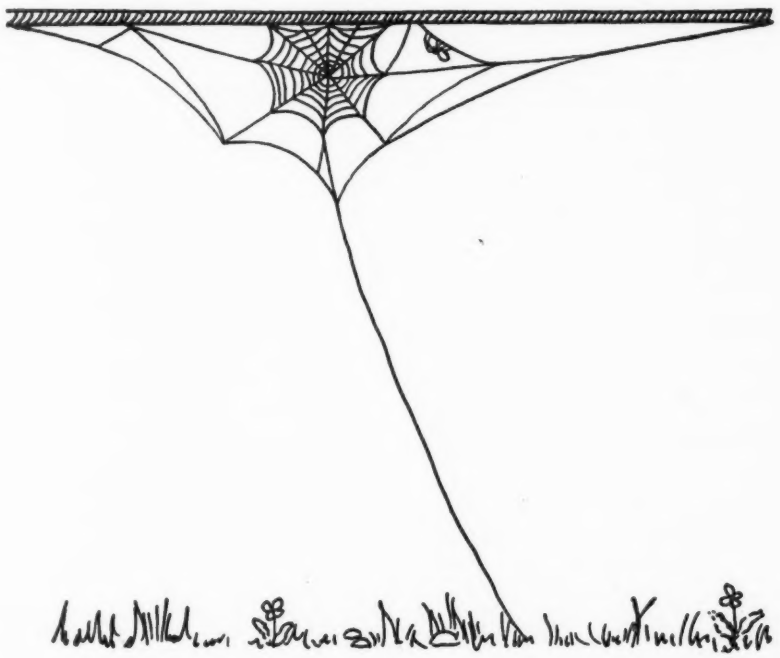
IN the case of bees, a whole group of habits has recently been referred to a special eye-equipment, which registers the refraction of light in such a way as to orient an exploring bee which has found a pollen source. This is followed up by signals in the hive, when the exploring bee has returned to its fellows, which convey information about the direction of the new pollen hoard. This message appears to us as though it were what we would call an abstract idea, such as that involved in a map. Are we to entertain seriously the assumption that a formal language is being used? If not, then how are we to explain the employment of communication elements comparable in abstraction to those of a self-analytical human? The bees which get the explorer's message start off in the right direction in a "bee line." Let us suppose that what has been communicated to them is an impulse to follow a line in an optical field invisible to us, and, if not sensed by the bees, at least influencing

them in some way. The dance of the explorer bee is then not an abstraction, but designed to stir a response in the other bees to a channel as clear to them as might be the course of a river current to a fish. Whatever its source, this certitude is an extension of consciousness far beyond that of the spider, which has definitely withdrawn from the hazards of a wide range of environment by constructing its own and inducing its food to come to it, instead of having to pursue it as all winged insects, and as the running and jumping spiders, must do.

Birds also exhibit what may be operative awareness of an expanded field. The Pacific plover flies hundreds of miles over the open sea without taking bearings on sun, moon or star. Likewise, the European and American elvers find their separate ways, unguided by the parent eels, to the correct ancestral coast hundreds of miles away. Such homing instincts have always been puzzling, and attempts to explain them based on sensory perception, reactions to polarized light, etc., do not dispell the possibility that they are manifestations of a bio-psychic field. But we are still looking for a place where we can come to grips with its geometry. What we want to know from the orb spiders is whether their structures are part of a larger mathematical continuum made up of many interlocking fields which constitute a total bio-morphological and ecological system, in which the varied bodily morphology and habits of plants and animals can be regarded as test objects. The two fields we know already—the gravitational and the electromagnetic—are so characterized, each by an internally consistent geometry.

Orb spider webs may prove to be systems of coordinates of one very small portion of an over-all, rich and subtle field-geometry, simple and visible clues to the existence of such a domain, whose chief value lies in that they are visible, and they are wholly geometric. That we have not hitherto detected such a field means little. People have been creeping, walking, stumbling, falling in the gravitational field for millenia, yet its existence has been suspected for only a few generations and its mathematical establishment was achieved but yesterday. In fact, even now only a few know the significance of gravitational and electromagnetic fields, because they cannot hear, see, touch or taste them.

Thought is a laborious business. The sock-eyed salmon may not think, but somehow he knows his way about. We humans do a good deal of thinking, but as regards our own environment we seem to be lost in the maze of our matter-and-energy artifacts, as these grow ever more powerful, sensate and seductive. Authoritative disclosure of any lawful system in the more ethereal levels involving human conduct or societal organization must await serious research to establish, if possible, the existence of fields of higher order than those of matter and energy. It seems obvious that the first step is the extension of laws known to physics and chemistry right through the biological domain.



THE NEED FOR INTEGRATED EDUCATION:

Problems of Science Teaching

EVERY one of our readers is, by now, acutely aware of the latest preoccupation in educational circles: the race to educate scientific manpower at a pace to equal or to surpass that of Russia. In *The Scientific Monthly* for June, 1956, this was discussed as "The Crisis in Science Education," in three papers by Charles Dollard, Arthur S. Flemming, and Alan T. Waterman.

Dr. Dollard, discussing "Current Problems in Perspective," gives an excellent analysis of the situation which, in our opinion, will probably spur many school systems and guidance personnel to "sell" science to more students in the belief that the matter is one of quantity exclusively. Dollard makes himself clear on the point that, while the failure to recruit an adequate corps of scientists and technologists is extremely serious, ". . . the failure to recruit the much smaller number of men in each generation who are capable of the original and creative work that makes science a growing thing might well be fatal."

This, of course, implies that the problem has deeper roots and wider ramifications than can be solved by more intensive salesmanship for science and engineering courses and vocations. The problem poses both quantitative and qualitative challenges, which our public school systems have been criticized for failing to meet. Dr. Dollard lists these failures, which are now painfully familiar, and admits that "each of these indictments has a large element of truth in it." He details a number of specific changes that are being made to remedy the situation, such as salary scales, teacher inducements, and so on. Still more important, however, from our point of view is his statement that "There seems to be general agreement that science will best be served not by improvement in science teaching alone but by raising standards of instruction across the board."

Thus we have a call for a truly new kind of education from no less than the Chairman of the Committee on Scientific Personnel and Education of the National Science Board. He does not go into detail regarding his suggested balanced and integrated curriculum. We wish he would. However, in discussing why young people do not choose science, he indicates his belief that something is wrong with the over-all perspective and philosophy of present-day education. He believes that young people have a different and less attractive image of the scientist and technologist than they had a generation or two ago. "But science as a creative activity must compete for talent against all the other exciting and socially useful professions and vocations which a great industrial organization offers its young men and women. . . . In the last analysis, science cannot hold its own in this country unless we convince our young people that, as of old, the life of a scientist is a life of freedom, of adventure, and of self-fulfillment."

Dr. Flemming, director of the Office of Defense Mobilization, in his paper, "The Nation's Interest in Scientists and Engineers," also enlarges the problem beyond the scope in which too many may be inclined to view it. In addition to scarcity of trained scientists and technologists, he flatly states, "We are not utilizing in the most effective possible manner *those who have been trained* as scientists and engineers."

Dr. Flemming also casts the immediate educational problem into a broad, general cultural frame of reference with this statement: "We must raise the level of management competence in the fields of business, government, and education. . . . In all three areas there has been a failure to identify an emerging problem; a failure to utilize in the most effective manner the resources—both human and material—that have been available; a failure to provide a climate that challenges men and women to live up to their highest possibilities."

Such a statement correctly puts the problem beyond the range of easy, immediate expedients, and relates it properly to an all-inclusive view of human culture, human life, and the human intellect. "If we are to solve the manpower problem that exists in the fields of science and engineering," Dr. Flemming continues, "we first must do a far better job than has been done up to now in providing effective leadership in the field of human relations. . . ."

Dr. Flemming also touches on the other side of the picture—the familiar area of specialization. This is important because of the temptation to turn out custom-built specialists for the particular urgent jobs which need to be filled. ". . . the trend [of specialization] is sure to continue," he says, but "It must, however, be accompanied by adequate emphasis on work

in the humanities, social studies, philosophy, and religion. Such studies are absolutely essential if the management personnel of tomorrow are to be provided with a center and direction for their lives." To this end our secondary school system must be strengthened, for ". . . the only way in which America can meet the challenge of communism is by widening—not narrowing — opportunities for growth and development on the part of individuals. . . . If we are willing to give sacrificially of our time, energy, and resources to keep America strong and to strengthen our spiritual foundations, we are a part of the answer to the problem."

This, indeed, is heartening talk that indicates a better future in which science and technology are integrated on the old foundations of freedom, human dignity, and things spiritual.

Dr. Waterman, director of the National Science Foundation, adds to this discussion a paper entitled the "Role of the Federal Government in Science Education," which is important material for those who approach the current question of Federal aid in education without historical perspective. As Dr. Waterman points out, the Federal government has always aided education, from the time that lands from the public domain were first set aside for schools. In 1862 the Morrill Act established land-grant colleges, and in 1887 the Hatch Act provided money for (agricultural) research and development.

This paper reviews the current efforts to solve our manpower crisis which comes just at the time ". . . when our educational institutions are sorely beset by unprecedented numbers of students." The author concludes that "The real challenge is to make people generally aware of the extent and gravity of the crisis. Whether we can, and whether they will respond in time, is an open question. The people who established this country and pushed its frontiers across two thousand miles of wilderness were men and women of endurance and tough moral fiber. . . . Now the frontiers are those of the mind. Are we to shrink from equipping our children with the intellectual toughness and vigor that are needed to meet the challenges of a technological age? Or are we to assert that the 'hard' subjects, such as languages, and logic, and mathematics, and physics, and chemistry are too much for them and have no appeal? It would be strangely incompatible with our heritage if we should."

In *School and Society* for May 26, 1956, Rear Admiral H. G. Rickover, of the U. S. Atomic Energy Commission, joins the discussion in considering "Engineering and Scientific Education." He adopts a similar broad viewpoint: "The real issue is not whether the present-day pupil compares favorably with the pupil of 1870, but whether he is adequately trained for the demands of today's society. I submit that he is not, on the basis of study, intuition, and the experience gained from interviewing more than one thousand college graduates over the past ten years. I discovered that all but a small number . . . lack proper motivation. . . . They use the college as a 'service station.' This desire for security in terms of money, rather than in opportunity for self-improvement, is hard to understand in a society where security is so readily available."

Does this serve to point up a weakness in education: training in specialization without consideration for broad moral, philosophical, cultural, and spiritual roots? ". . . they know many facts—but they have not learned many principles," Admiral Rickover concludes, having marshalled in support of this statement much data which we wish space permitted us to repeat. He considers that the failure in education is not the fault of educators alone; "it is the fault of all of us in not recognizing the impact of the 20th century scientific revolution and taking the necessary measures in time." A further consideration is the serious problem of adequate education for our gifted children. "True democracy does not require of us that we hold back the qualified; it does require that we give each individual the opportunity to develop his talents to the fullest."

Concurring in the need to take the broad integrative approach to the immediate problem, Admiral Rickover concludes that we ". . . must produce citizens who have the wisdom, the vision, and the knowledge to grapple successfully with world problems, citizens who can see critically through conventional values and who are able to subject to principle and reason all claims to power."

These men are all pointing to truly integrative education.

—*Harvey W. Culp*

Space-Time Interaction of Planets and the Sun

FOR some ten years the Central Radio Office of RCA Communications has been making a systematic study of the effect of planetary positions on the sun, with a view to forecasting radio storms which affect communication systems. J. H. Nelson, who is in charge of the observations, has reported in several articles* that their correlation shows that certain planetary arrangements agree well with the behavior of short-wave signals.

It is significant that the conclusions which were reached so long ago as 1952 still stand in the light of later work. At that time (May 1952), Mr. Nelson made a review of correlations of observations which appeared in *Electrical Engineering* under the title, "Planetary Position Effect on Short-Wave Signal Quality." Because of interest which has recently been aroused in the subject, it seems desirable to record here the conclusions reached at that time.

Nelson states that the work was stimulated by the efforts of other investigators, notably Huntington, Clayton and Sanford, to connect cyclic variations in sunspot activity to influences of the major planets. It was decided to investigate the effect on radio signal behavior of all the planets, from Mercury to Saturn, using the same heliocentric angular relationships of 0, 90, 180, and 270 degrees, and recording dates when any two or more planets were separated by one of these angles.

It was found that positive correlations occurred between these planetary angles and transatlantic short-wave signal variations, which showed a tendency to become degraded within a day or two of this kind of planetary configuration. However, it was noted that certain configurations showed much better correlation than others, and special study was devoted to these most severe degradations.

This led to the discovery that when three planets held a multiple of 90 degrees arrangement among themselves, the correlation was more pronounced. These "multiple configurations" exist when two planets are at 0 degrees with each other, and a third planet is 90 or 180 degrees away from them. A multiple also exists when two planets are separated by 180 degrees with a third planet 90 degrees from each. These two types of multiples are quite common. A more uncommon type, and one which shows the least correlation, occurs when all three planets are at 0 degree with each other.

Many of the multiples are completed in the space of a few hours, accompanied by sharp, severe signal degradation, while others may take several days, accompanied by generally erratic conditions during the period. The time consumed depends on the relative speeds between the three or more planets involved in the multiples, which show correlation for plus and minus about 5 degrees from the exact arrangements.

Configurations of this type actually can be considered as cycles, and when several cycles peak at the same time there should be maximum effects. Nelson cites records for three years, 1948, 1949 and 1950, to demonstrate this point, selecting the same cycles between the same three planets, Mercury, Venus, Jupiter, in order to provide consistency of data. Such an arrangement is referred to as a multicycle. All the close multicycles between these three planets were correlated with existing radio conditions, resulting in ten cases ranging from slight to extremely severe. The heliocentric arrangements are shown in figs. 1 and 2 for cases 1 and 10, the latter being a triple multicycle, involving Uranus and Saturn as well, that coincided with extremely severe signal degradation in 1951.

It was noted that single configurations between two isolated planets showed the least correlation although at least slight degradation is usual, and occasionally

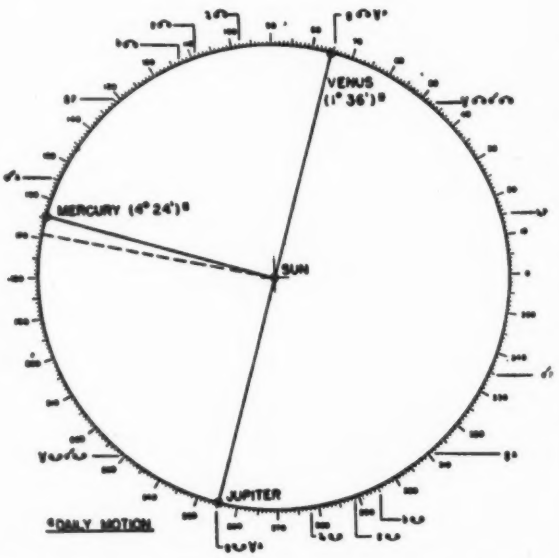


Fig. 1. The heliocentric arrangement of Venus, Mercury, and Jupiter on February 23, 1948, which resulted in severe signal degradation on that day and the one following.

*His first article was "Short Wave Radio Propagation Correlation with Planetary Positions," in the RCA *Review*, March, 1951. Subsequent to the article reported herein, a general meeting was held to discuss this work, and a summary, entitled "Radio Weather Forecasting Techniques," was published in the *Transactions* of the Institute of Radio Engineers, Vol. CS-2, No. 1, January 1954.

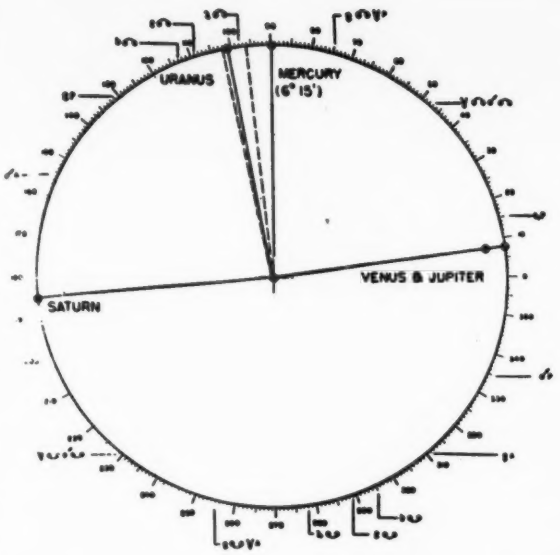


Fig. 2. The heliocentric arrangement of five planets shown resulted in extremely severe signal degradation from September 20 to 26, 1951.

some is severe. But when several single cycles between several isolated planets coincide in time, the correlation may be quite pronounced. At times two or three multi-cycles will occur in the space of a few days, and at other times one will occur mingled with single cycles between other planets.

"Theoretically," Nelson states, "if these planetary arrangements do have the effect that correlation indicates, the cycles between the slow planets should have gradual long-term effects establishing an over-all standard. The most degraded periods should come as the faster planets come into cycle with them or among themselves.

"Jupiter and Saturn, the largest planets in the solar system, are the most important. Due to their great size and slow motion, they can exercise the predominating influence on the sun for prolonged periods of time, and therefore establish an over-all standard of disturbed or quiet conditions. . . . Therefore, when Jupiter and Saturn are spaced near any multiple of 90 degrees, we should find the most degraded years with a high percentage of the radio disturbances severe.

"The year 1951, which was a very degraded year, is an example of this. A slow planet multiple existed between Jupiter, Saturn, and Uranus, with Jupiter and Saturn at nearly 180 degrees and Uranus almost 90 degrees from each. [See fig. 2] This arrangement set a low standard for 1951, and even normally weak cycles between isolated planets showed an effect. The radio disturbances were prolonged and severe. . . .

"The records indicate that when Jupiter and Saturn were spaced by a multiple of 60 degrees, radio signals were of better quality than when spaced by multiples of 90 degrees. Under such an arrangement there are fewer multicycles. During such years a high percentage of the single cycles show no important correlation except on the normally weaker circuits. . . .

"It is worthy of note that in 1948, when Jupiter and Saturn were spaced by 120 degrees, and solar activity was at a maximum, radio signals averaged of far higher quality for the year than in 1951 with Jupiter and Saturn at 180 degrees and a considerable decline in solar activity. In other words, the average quality curve of radio signals followed the cycle curve between Jupiter and Saturn rather than the sunspot curve. . . ."

The author concludes by stating that he considers this hypothesis of a planetary-positions effect upon the quality of short-wave signals as a new approach which should be considered as one more tool for the researcher, in an area which needs a tremendous amount of work.

"The correlation found between signal degradations and these planetary arrangements in the past has been sufficiently consistent to indicate that under these arrangements, particularly in the case of multicycles, the planets possibly influence the sun in such a manner as to cause a temporary change in its radiation characteristics. The ionosphere of the earth is apparently particularly sensitive to these changes and reacts accordingly.

"By combining planetary indications with solar observations and a day-to-day signal analysis, a 24-hour forecasting system has been developed which averaged close to 85 percent accuracy throughout 1950 and 1951 as reported by RCA Communications at Riverhead, L. I., New York."

—F. L. Kunz

Nature's Superb Optical Designs

"THE Eye and Its Structural Adaptations" is discussed by Dr. S. R. Detwiler in the January, 1956 issue of the *American Scientist,* pp. 45-72. The author has for the past forty years collected and studied the eyes of animals as an avocation. His field of specialization is experimental embryology.

The eyes of animals are constructed upon a common architectural plan, but, the article points out, "Despite this fundamental structural scheme which is characteristic of all vertebrate eyes, nature has produced many deviations from the common plan with respect to the light collecting apparatus, the focusing devices, the light receptor elements, and the nervous transmitting pathways."

Dr. Detwiler reviews the general evolution of the eye in vertebrates as follows: there is an increase in the number of visual elements per unit area, an appearance of a highly differentiated central region in

the retina, a gradual swinging forward of the eyes in the head so that the visual fields are made to overlap —thus making possible binocular vision, a partial crossing of the optic nerve pathways to the brain which makes possible stereoscopic vision, and an elaboration of a visual brain cortex that makes possible the capacity for intelligent appreciation of complex visual patterns and the power to form reasoned visual judgments—a vital evolutionary accomplishment in helping to establish the intellectual supremacy of man. We are reminded that the eye of man "cannot be considered as representing the acme of efficiency as an optical instrument. Its functional predominance may be said to be dependent upon its connection with the unique and transcendent evolution of the associated visual cortex, rather than its precision as an optical system."

The author compares the eye and a camera and shows the striking resemblances. He explains, too, that there is no constant relation between eye size and body size; size seems to be dependent to a greater degree upon the nimbleness of an animal's movements and its necessity for acute vision rather than upon its bulk. A striking deviation in the form of the eye is that seen in deep sea fishes. Their eyes are tubular and have enormous lenses. Another interesting adaptation is found in the eyes of fishes that swim at the surface of quiet waters. The eyes are "double" with one portion used for vision in the air, one for water vision. The mud skippers have eyes encased in high turrets.

Dr. Detwiler discusses the differences in the habits of animals as related to their eyes. Many animals have eyes that can be used well both in the daytime and at night (arhythmic forms), others are active only at night (nocturnal forms), and still others are active only in bright light (diurnal forms). The fundamental differences in retinal structures and adaptive mechanisms is discussed in detail. A mechanism is described for adjusting the eye to changing illumination in the case of certain fish and amphibians where pupillary response is either nil or very slight. This is known as the photomechanical changes in the retina. "In bright light the cones contract, the rods elongate, the epithelial pigment migrates down over the rod outer segments to shield them from strong light. . . . In dim light or darkness, the rods contract, the cones elongate and the pigment contracts back towards the body of the cell."

The eye-shine (when light falls upon the eyes at night) seen in many animals is discussed briefly. It apparently serves to increase the sensitivity of the eye in the presence of weak light.

Since there is so much variation in the photosensitive elements and the general retinal structures of different animals, their visual acuity must vary accordingly. Dr. Detwiler describes many very interesting adaptations that are found in the eyes of the many animals he has studied. He discusses some of the theories that have been proposed to "explain" the functions of the structures described.

The author concludes his report with the following ideas: "No matter how extreme are the structural aberrations from the common fundamental plan, they have a real meaning in the visual framework in relation to the environment in which the animal lives. Personally I know of no vertebrate organ which has undergone so many evolutionary adaptations to meet the environmental needs as has the eye. Nature has been experimenting for millions of years with this optical instrument, not constructed out of brass and glass as man's camera, but primarily out of 'skin, water, and jelly,' and her various optical designs cannot help but intrigue anyone who is interested in structural design in relation to the functional requirements of the environment."

—Ruth Lofgren

Methodology from Science for Theology

EVERY year a conference on "Religion in an Age of Science" is held at Star Island, in which a number of prominent scientists participate. The conferences have discussed many facets of the problem and have produced papers of interest to all those who are concerned with the impact of science upon traditionally formulated conceptions of man and the universe in which he finds himself.

One such paper, entitled "A Unified Method of Science: Can It Be Applied to Religion?" was contributed by Henry Margenau and reported in full in the May 1956 issue of *The Christian Register*. In it he discusses such questions as the method of science, the nature of concepts, prediction, the relationship between data and constructs, and the development of scientific theory, and makes the point that scientific constructs are regarded as valid if they satisfy two sets of requirements: first, the methodological, or metaphysical, concerned with the native fitness of the constructs themselves; and second, the requirement of empirical verification. No limit seems to be set with respect to man's progress in the development of constructs, but the facts of experience are certainly limited. If science is restricted to the area of experience, it obviously cannot deal with problems that transcend experience. Professor Margenau considers the existentialist view, which holds that experience cannot be confined to the data of science, but must include also the contingent and spontaneous features of our total experience, "which escape the net of rational analysis." Questions which are concerned with the "whys" of existence will probably never be answered by science with its present methodology. Yet the area which Margenau calls the P-plane (of per-

ion) is obviously a point of contact between sci- and religion, in that there appears to be no con- between science and existentialism, which rather d in a relation of complementarity.

rofessor Margenau is hopeful that a theory of re- n, i.e. theology, may, when fully developed, ex- t the same formal structure as science itself. If is to be begun, the P-plane of religious experience t be determined. A possible answer would be, he gests, the kind of immediate experience which is n regarded as distinctly religious, such as the reness of conscience, the feeling of awe, the long- for grace. These experiences are not exclusively gious, for they are acknowledged by several of the al sciences, but this does not prevent their legiti- mate analysis in religious terms. The next step would be the subjugation of religious constructs to the same metaphysical requirements which are imposed on scientific theories: logical fertility, multiple connection, simplicity, and the like. Moreover, if religion is to have the structure of science, it must also expose itself to empirical tests, and this would immediately force the rejection of certain kinds of theology, which could never be tested. Margenau makes it quite clear that he does not advocate "physicalism" in religion, or any slavish adherence of theological doctrine to the constructs of physics and chemistry. Rather it is the methodological structure of science that might be transferable to the benefit of modern theology.

—*E. B. Sellon*

EWS AND NOTES

N cooperation with the Foundation for Integrated Education, the New School for Social Research is ering a series of lectures and discussions by Henry rgenau, Higgins Professor of Physics and Natural losophy at Yale, under the general title, "Philoso- ical Perspectives of Modern Physics."

The course is explicitly concerned with the crisis of time, which arises in large part from a mismatch ideas in different special fields of learning. Too fre- ntly the science of the past is confronted with the blems of today, or up-to-date knowledge in one cialty is compared with antiquated notions in an- er. This results in erroneous thinking and emotion- dissatisfaction. Integration of thought, elimination paradoxes, can often be achieved if contemporary as of science are brought to bear upon the philoso- ic ethical problems troubling our day. The con- porary ideas of physical science are to be presented non-technical form, and assessed for their relevance certain important problems of philosophy.

The sessions, which will occupy eight Tuesday eve- gs, one in each month from October through May, ll concern themselves with the following subjects: e meaning and the faith of science; The doctrine materialism and its scientific basis; The decline of terialism in our century; Quantum theories and e problems of determination and freedom; Einstein's lativity and relativism of social norms; Positivism, istentialism and modern science; Can science pro- de ethical principles?; The modern predicament and possible removal through integrative forces present thin science and philosophy.

Registration may be made at the New School, 66 est 12th Street, New York 11, N. Y., at any time up to and including the date of the first lecture, October 16th.

IN this issue of MAIN CURRENTS a biologist and a psychologist—writing, of course, independently—make references to the implications of parapsychology. Wide acceptance of the new field now seen indicates that the phenomena studied under this term have for some time been well established empirically.

The Parapsychology Foundation, Inc. reports steadily increasing numbers of experimental projects, some of which it facilities. The most recent item has been the establishment of a Parapsychology Laboratory at St. Joseph's College, Philadelphia, to be headed by Dr. J. Carroll Nash.

The publication in *Science,* August 26, 1955, of a regrettable article by Dr. George R. Price shows that the empirical proofs are already adequate in number and variety to disturb profoundly those whose present philosophy is rendered untenable thereby. This imbalance between the excess of fact and deficiency of theory is an unhealthy state of affairs, and it is reasonable to suggest that the time has come to spend at least a proportionate share of money on types of research which systematize, by valid theory, some part at least of that which has been established factually. By this means, workers could open up the possibility of giving parapsychology a status which it cannot have so long as it continues to be so deficient in theoretical structuring. Theory alone can be expected to relate this part of the growing edge of knowledge to the main body of science.

Towards a Psycho-Social Theory of Relativity

IN driving home, over and over, a realization of the crucial fact that the *same* behavior may, in diverse cultures, indicate *different* kinds of abnormality or none at all, Marvin Opler brings together in *Culture, Psychiatry and Human Values: The Methods and Values of a Social Psychiatry* (Charles G. Thomas, Springfield, Ill., 248 pp., $6.00), a large part of the vast literature on the symptom pictures in various parts of the world and their etiologies, creating probably the most comprehensive source upon the distribution of mental illnesses among the world's peoples. Except for its author's modesty, this book might well, it seems to me, have been called "Introduction to the Psycho-Social Theory of Relativity." It tends to focus the insights of scores of psychologically trained sociologists and sociologically oriented psychologists who have been striving to correct the fundamental but misleadingly "universal and eternal" concepts of Freud, Adler, etc. in the same general way that Einstein corrected those of Galileo, Leibnitz, Newton, etc.: by systematically taking into account the modifying effects of the variously accelerated coordinate systems relative to which all phenomena, physical and mental, occur.

Evaluating diverse cultures — coordinate systems in terms of which mentation proceeds—Opler warns that "Types of abnormality common in Western European and American cultures erroneously provide 'clues' to the understanding not merely of clinical typologies, but cultural ones as well. By claiming a close correspondence between the clinical model showing predispositions toward extreme forms of psychiatric behavior and adult personality, the culture is so stereotyped." (pp 179-180) "What is needed to fill the framework of inter-disciplinary collaboration are two things beyond the usages of anthropology and psychiatry. . . . One is the necessity for psychiatry systematically to gather data on social and cultural backgrounds and systems of meaning which configure always in the background of real cases. The second is the necessity for anthropology to become sensitized not merely to the cultural backgrounds from which cases emerge, but to the typical modalities of mental functioning in human beings." (pp 189-190)

This means bringing together the literature on the culture pictures in diverse parts of the world, and *their* etiologies, the other condition for formulation of transformation laws. "There is no reason to feel," Opler says, "that a culture may not be studied and diagrammed for ambiguities, conflicts, discontinuities in life course, obvious stress features, and healthy developments." (p. 20) "[And even more usefully, diagrammed for] positive aspects of culture in interpersonal relations for creative and productive purposes." (p. 173)

In the small space available, I can either describe this book's enormous contents a little more or outline some of its important uses, but not both. Since I am writing for the journal of the Foundation for Integrated Education, whose members are exploring all possible means for furthering synthetic education and research, I choose the latter:

Here is a textbook, a starting point for courses not just in the extreme clinical forms of mental disorder, but also on the even more important non-clinical modern forms which, while clearly displaying characteristics of epidemics, are viewed in each of their respective cultures as eminently normal and desirable conditions; namely, the so-called *ideologies*. These display Fromm's "culturally patterned defects" which Opler calls "pathological *tendencies* which a combination of cultural and psychiatric methods may bring to light even in the study of the so-called normal." (p. 192) (To be scientific rather than pugnacious such courses would have to include as intensive studies of locally accepted as of unaccepted ideologies.) This book can thus be the starting point of courses not only in psycho-sociology and anthropology, but in the technology for which the times cry out, in psycho-politics, the application of psychology, not to warfare, terror, and predatory sales, but to mass healing.

With the geometrization of the Rorschach protocol by George T. Lodge and associates; with the geometric classification of temperaments; of their typical changes under stress (not only negative ones, called *neuroses* and *psychoses,* but also positive *tours de force* of creative genius); as also the geometric coding of political philosophies (all of which are in print, in press, or in manuscript) the formal tools are at hand for implementing Opler's theory of psycho-social relativity in fairly exact and very practical ways. For in the last of these cases the coordinate system, relative to which classification occurs, represents the combined value systems of all theoretically possible cultures, infinitely subdivided in regard to quality, quantity, and sense.

Opler's proposed systematic diagramming of cultures by inter-disciplinary teams, such as the one on which he has been working at New York Hospital during the last three years, could, I believe, achieve the following objectives: Disclosure of the negative psycho-social structures which bring on or aggravate, and positive ones which prevent or alleviate these chain reactions. Disclosure of the critical points at which the negative and positive forms of these epidemics break out. (The former, the tactical objective of every Cold War campaign, is called the "revolutionary moment" in the ideologists' strategy textbooks.) And it could pinpoint the local forms which they may, in any given time and culture, be expected to assume; forms such as the Ghost Dance of the late 19th Century American Plains Indians, Poujadism in France, racism in Nazi Germany and parts of the U.S.A., amok in Malaya, Stalinism in the U.S.S.R., the Marching Rule in the post war Solomon Islands, the Tarantula cult in Mediaeval Italy, and so forth. By helping the formulation of positive (preventive and curative) measures, and their testing in the field, psycho-political relativity theory at last gives us mental equipment against the psycho-political scourges of our day, whose victims far outnumber those of the Black Death in Mediaeval times.

Our Atomic Age is, of course, due mainly to the relativization of physics. The mutual relativization of psychiatry and sociology is thus the condition for bring-

ing the sciences and technologies of mind and culture abreast of the Atomic Age; for regaining control over our environment. Equipped with Opler's textbook, enterprizing psychologists, sociologists, anthropologists, and political scientists can at last organize *modern* courses. That is to say, courses for training leaders to handle the decisive forces of our time.

—*Edward F. Haskell*

A Synthesis of the Plastic Arts

PAUL DAMAZ in his *Art in European Architecture* (Reinhold Publishing Corporation, New York, 1956, 228 pp., index, 346 halftone and 14 color illustrations, text in French and English, $10.00), whose French title, *Synthèse Des Arts,* more clearly reveals his passionate conviction that there is a need for reintegration of the arts in relation to architecture, has within a small compass attempted to deal with a vital and difficult subject. The difficulties which reveal themselves in a large proportion of the numerous illustrations of this handsomely designed volume are at once suggested by LeCorbusier in his preface when he says: "To talk about a synthesis of the arts in Europe today is already a proof of optimism. This synthesis may exist in the minds or hearts of a few people, but it has not yet become a reality. Positively there is an immense breach between those who build and those who claim their place in the building."

In the section of the book containing Damaz's discussion of the nature of and the causes of the separation of the arts and architecture there are numerous excellent observations, but some of the author's conclusions seem less than well reasoned. Damaz leans heavily on the opinion that the cause of the separation of the arts from architecture is the early 20th century break with the past, including painting and sculpture, to follow a narrow and wholly material "functionalism" which ignored architecture as an art to conceive of it as engineering. This reviewer at least would have preferred that the author might have used such a term as "unimaginative utilitarianism" or that he might have dealt somewhat more fully with the various connotations of the term "functionalism" (see Talbort Hamlin's *Architecture Through the Ages,* G. P. Putnam's Sons, New York, 1940, chapter 33), as it was the unimaginative and tasteless "utilitarians" and not the true "functionalists"—the pioneers of the International Style, whose all too few building commissions are masterpieces—who are to be blamed for the aesthetic poverty of modern building, for in an observation of Gropius included in the text it is stated: "The word functionalism has been taken too materially. . . . Functionalism for us meant embracing the psychological problems as well as the material ones."

"Functionalism" in architecture, like Cubism and its derivatives in painting and sculpture, was an extreme doctrine, but extremes were needed to free architecture of its accumulations of eclectic decorative debris which had long since ceased to serve any human or spiritual function.

In Damaz's discussion of the place of art in our civilization he similarly does not elucidate his subject as clearly as he might. He says, "When industry made its appearance in the 19th century, it was considered to be a purely 'functional' ["utilitarian" would have been better here also] element of our civilization, aimed at our reason and having nothing to do with feeling. Science, industry and technology have developed to such gigantic proportions as to become the representative elements of our time, whereas philosophy and art retreated to solitary spheres and became more and more cut off from life. Thus art has fallen back on itself and has hidden its existence in the mysterious studios of the artists, in dealers' galleries, in the houses of the choice few, and in museums. . . . The materialistic nature of our civilization is visible in the program of the schools, where there is an increasing tendency to teach what can be useful in everyday life, and to neglect subjects more fitting to develop the mind."

Damaz goes on to say that art in totalitarian countries is in "full decline" and decries the individualism elsewhere which he sees to approach the "anarchic." While we can agree with him that "never in any period in history has there been such a diversity in the arts," many will see as a positive value the fact that the arts have freed themselves from the necessity of association with architecture to become free activities of the human spirit, to result in highly original search by artists, rather, than as he does, see it as a "conflict of personalities." And while almost everyone will agree upon the need for renewed collaboration, not everyone will agree with him that there must be a unity of thought or belief among architects and artists, or that such a unity existed in the Middle Ages to the degree that he appears to suppose. Damaz, as have others, associates this unity with the Gothic, but there are many of us who without wishing to patronize the grandeur of the Gothic prefer the vitality of the Romanesque in which there was an enormous degree of personal artistic experiment comparable to the present day. In the realm of thought, Renaissance man was happy to break the shackles of Gothic limitations.

In the discussion of the nature of and the causes of separation of the arts and architecture, Damaz states his dissatisfaction with the present state of architecture and its relation to the arts, and gives as the two extremes to be avoided, the mechanical precision of the engineer architect which may be mistaken for beauty, and the over-elaboration of the "decorator." Among the causes of the present alienation he lists the separation of thought from feeling stemming from Descartes and the 18th century "age of reason," the decline of culture among the clients of the architects, whether they be private individuals, business or commercial groups, church or government, the influences of modern economy and technology, the new materials and methods of construction, the limited life span allotted to buildings, and the primary emphasis upon utility and profits from the investment.

The author gives a series of brief and often acute analyses of the relation between architecture and the arts in the past, in Egypt, Greece, Rome, in the Byzantine, Gothic, Renaissance and Baroque periods, and discusses the pioneers of modern architecture before he enters upon a treatment of some of the problems concerning "A New Synthesis of the Major Arts," "The Spiritual Functions of Architecture," "The Teaching of Art and Architecture," "Architecture and Color," "The Principles of Mural Painting," "Abstract Painting and

Modern Architecture," "Architecture, Sculpture," and "The Renaissance of Stained Glass."

In the latter part of the text, which is interspaced with the many photographs, there is a treatment of "Art in Post-War European Architecture" in which the goals of various international associations of architects and artists and statements of individuals are given, in addition to an attempted résumé of the accomplishments in the use of the arts in relation to architecture in the various countries, in public buildings, factories, schools, hotels, restaurants, stores, theatres, exhibitions and fairs, religious buildings, apartments and private houses, gardens, parks and ships.

—*Louis James*

Scientific Method in Medicine

A refreshing approach to one of the big problems in present-day medical education is presented by J. H. Woodger in *Physics, Psychology and Medicine* (Cambridge Univ. Press, 1956, 145 pp., index, $1.75). The book subtitled "A Methodological Essay," was originally addressed in the form of lectures to staff members and senior students of the Middlesex Hospital Medical School. As the author states in his Preface, he considers a number of questions which are commonly regarded as controversial in as neutral a manner as possible, hoping thereby to find a viable middle position.

One of the questions he poses is this: Why is it, when two-fifths of the hospital beds are occupied by mentally ill patients, so little time is devoted to mental health in medical school? (In case this proportion seems to some readers to be ultra-conservative, it must be remembered that Dr. Woodger is addressing an English audience.)

In order to understand such problems as this, the author feels we must have some idea as to the factors that determine the way we go after the things we want to find out. Thus the earlier part of the book is devoted to explanations of the scientific method: to an understanding of the distinction between generalizations of observation-records and explanatory hypotheses. The point is made that we can be so attached to successful hypotheses that we dogmatically hold on to them and "explain away" facts which do not fit into them, thus blocking our search for truth.

This may be one of the reasons why research in mental fields has not been so fruitful as that in the physical sciences. Since these latter have been so successful in their practical applications, there is a feeling that their methods are the only ones likely to be successful even in other fields, and that they constitute the only scientific approach. The author feels, however, that if you "recognize no scientific method which does not closely follow the model commonly supposed to be furnished by physics," then "this is clearly to take an authoritarian and legalistic attitude . . . towards questions of meaning."

Dr. Woodger prefers "the view that as new sciences and new methods arise and develop so must we be prepared for revisions in our notions about what is to be called scientific." He adds: "Some important discoveries have been made in medicine with purely clinical methods without the help of experiment. . . . It would be pedantic in the extreme to reject all procedures which do not have a foolproof experimental basis, and it would great misfortune if all clinical observation were despised and condemned as unscientific." Physica ence naturally considers the objective, and has it methods. The science of the mind and the psyche work with the person and the subjective. It must different methods, suited to its own field while still taining the scientific attitude.

—*O. J. Bengtsson, M.*

Two Complementary Approaches in Biology

TWO outstanding books are recommended to all interested in the science of biology. They are: *Experiments in Biology,* edited by Mordecai L. riel and Seymour Fogel (Prentice-Hall, Engle Cliffs, New Jersey, 1955, index, pp. 317, $3.75); *Classics of Biology,* by August Pi Su Suñer, the au ized English translation by Charles M. Stern (sophical Library, New York, 1955, index, pp. 337, $

These books are being reviewed together because demonstrate complementary approaches to the pro of helping us understand scientific methods and attit *Great Experiments in Biology* is charged with the vit enthusiasm, and pertinent experimental observatio characteristic of able young scientists.

"If science education is to convey this sense o relevance of science to man's problems as a social b it must not confine itself to the *results* of scientifi quiry, but must devote itself as well to the method and philosophic outlook that have led to these re Successful training in science involves the develop of a state of mind and a feeling of discovery, of pa pation in science, far more than the mere acquisiti factual knowledge.

"We have chosen less than a dozen areas in ge biology in which significant progress has been towards an understanding of the mechanisms under living activities. For each of these fields, we hav lected a sufficient number of classic papers to show milestones in the advance of knowledge starting raw observations and the first experimental groping quantitative physico-chemical studies of the present

"Inasmuch as our objective has been to convey s thing of what science is and the way in which sci grows, we have tried to present connected sequenc a chain of discovery within a field, in preference t fering representative selections ranging over that e subject. No attempt has been made to assess prior our choice has often been governed by simplicity of sentation, style or other nonhistorical criteria."

Great Experiments in Biology deals with seven m topics. They are: The Cell Theory, General Physi (enzymes, hormones, vitamins, metabolism), Mic ology, Plant Physiology (auxins, photosynthesis), bryology (germ cell theory, embryonic differentiati Genetics, and Evolution. Each section is introduce a chronology of the great discoveries in the field a brief orientation-discussion that calls the reader's a tion to the significant points to be considered. There also brief but informative footnotes accompanying quotations. It is assumed that the reader has some k

edge of chemistry, although most of the selections do not contain chemical formulae.

Classics of Biology, on the other hand, emphasizes many of the great philosophical theories that have developed in biology. The book radiates the maturity and wisdom of its author and the skill and sensitivity of its translator. There are sixteen sections: Matter and Energy in Life; Cell Theory; Stimulus and Excitation; Biocatalysts; Metabolism; Growth and Reproduction; Germ-cells and Soma: Sexual and Asexual Reproduction; Form and Dynamics of Reproduction; Heredity; Individual and Species; Preformation and Epigenesis; Life on Earth; Geography and Palaeontology; Causation and Design; Reflexes, Consciousness and Will; and The Whole and Its Parts. The author discusses each topic at some length before presenting the quotations he has selected from more than sixty writers. The continuity of the book is provided by the development of basic ideas: Aristotle may be followed by Descartes, by Claude Bernard, by Plato, by Max Scheler—in that order. And yet the argument proceeds smoothly and in a most stimulating fashion.

From the section, The Whole and Its Parts, the author discusses Organismal Biology as follows:

"Mechanism and vitalism are two standpoints of contemplation of the universe, depending on the field of vision, from whence problems are considered, according to the temperament of the student himself so that it becomes difficult to reconcile opinions which are antagonistic from their very roots up.

"The man of science does not have to demand from events more than they can offer as means of knowledge. Theories, the tools of the sciences, are needful and aid investigation, but they never attain the validity of factual explanations confirmed by practical experiment and experience. It is absolutely safe to say that physiology took on a new complexion at the start of the present century; that the organism must be looked on as a whole with its parts working together harmoniously as a compact entity and in a fitting manner, this being the distinguishing feature between the events of life and those of the purely physical world. This, however, being shown and granted, it still remains somewhat extravagant to state outright that fresh facts give the lie to the reality and governance of a biological causality determining the operations of the living organism."

As might be expected from the different tones of the two books, even when the same writers are quoted, the authors have, almost without exception, chosen different passages to illustrate their points. Both books are stimulating reading for anyone interested in biology, and together they give a very broad view of the mysteries, the discoveries, and the basic concepts of the science of life.

—*Ruth Lofgren*

Symposium on the Self

FROM time to time in these pages we have reviewed books which indicate that psychology in this mid-century is beginning to take a new tack, turning away from determinism, mechanism, and physical models. To this list we now enthusiastically add a new volume, *The Self, Explorations in Personal Growth,* edited by Clark E. Moustakas (Harper & Brothers, New York, 1956, 284 pp. $5.00). Nineteen top-flight authors, contribute a chapter each. These include G. W. Allport, Angyal, Fromm, Goldstein, Horney, Jung, Lecky, Dorothy Lee, Maslow, Mooney, Radhakrishnan, Rank, Carl Rogers, Sartre, David Smillie, Tagore and Frances Wilson.

This galaxy of writers obviously makes reviewing difficult. In the opening paragraphs of his preface, the editor expresses the content and theme better than any reviewer could: "Conern for the self with all its contributing attributes and potentials is rapidly becoming a central focus of contemporary psychological inquiry. More and more the interest is in the understanding of health and creativity as the exploration, expression and realization of human talents. There is a gradual but definite movement throughout the world to understand individual well-being more fully. . . . The selection of recent writings in this book portrays the fundamental unity of personality and presents a framework for understanding healthy behavior. The emphasis is on knowing, exploring, and actualizing the self."

A few randomly-selected sentences must suffice to indicate the scheme, the scope, and the style of this symposium:

"Experience is true to the person when he is himself alone. . . . In true experience every expression is creative, the creation of the person one is and is becoming. There is only the exploring, spontaneous expressing self, finding satisfaction in personal being." (Moustakas)

"Normal behavior corresponds to a continual change in tension, of such a kind that over and over again that state of tension is reached which enables and impels the organism to actualize itself in further activities, according to its nature." (Goldstein)

". . . the human being seems to be striving basically to assert and to expand his self-determination . . . [and] by the second tendency he seems rather to strive . . . to become an organic part of something that he conceives as greater than himself." (Angyal)

"The affirmation of one's own life, happiness, growth, freedom, is rooted in one's capacity to love. . . . If an individual is able to love productively he loves himself too; if he can love only others he cannot love at all." (Fromm)

"The creative expression of the personality in real experience, with all the deception of its emotional displacement and denial, is constructive. Self-knowledge (introspection) is and remains destructive with all its content of truth. We here strike the problem of the neurosis as a problem of consciousness. . . ." (Rank)

"So it is almost a truism to say that the world is what we perceive it to be . . . our mind is the principal element of creation. The world, while I am perceiving it, is being incessantly created for myself in time and space." (Tagore)

"The most constant factor in the individual's experience . . . is himself and the interpretation of his own meaning; the kind of person he is, the place he occupies in the world, appear to represent the center or nucleus of the personality. . . ." (Lecky)

"In assuming the importance of being realistic both for ourselves and others, we have seldom questioned the universality of our own reality." (Smillie)

"The peculiar privilege of the human self is that he can consciously join and work for the whole and embody in his own life the purpose of the whole." (Radhakrishnan)

". . . through an intensive analysis of language, ceremonial and everyday behavior, myths and magical formulas, it is possible to arrive at the philosophic basis of a culture and to see to some extent how reality appears to its members." (Lee)

"Personality is an act of the greatest courage in the face of life, and means unconditional affirmation of all that constitutes the individual, the most successful adaptation of the universal conditions of human existence, with the greatest possible freedom of personal decision." (Jung)

". . . to the basically deprived man the world is a dangerous place. . . . The basically satisfied person is in a different case. He can afford out of his abundance to take these needs and their satisfaction for granted and can devote himself to higher gratifications. . . ." (Maslow)

". . . the individual appears to have a strong desire to become himself; . . . given a favorable psychological climate he drops the defensive masks with which he has faced life, and begins to experience the stranger who lives behind these masks. . . ." (Rogers)

"The intensification of the aesthetic sense results in an inner perception of the very essence of being . . . a microcosm of the process and state that constantly recreates all that *is*. . . ." (Wilson)

". . . one may rightly say that the whole pursuit of success is intrinsically unrealistic." (Horney)

"The most critical problem today is that of how men are to deal with men—how nations are to treat nations, how groups are to treat groups, how man is to treat himself." (Mooney)

Such a symposium as this book represents indicates that psychology may be expected to forsake its previous preoccupations and get down to the business of helping us to understand what it means to be human.

—*Harvey W. Culp*

Cultural Aspects of Human Nature

HARRY L. SHAPIRO has edited a book, *Man, Culture and Society* (Oxford University Press, New York, 1956, 368 pp., illus., bibliography, index, $5.50) which is an anthology made up of essays by eminent scholars in the field of anthropology.

Seventeen modern anthropologists join in this volume. Each speaks with the authority of his area of special competence. The result is a volume which gives the intelligent reader an excellent picture of the development of the human race. While every chapter is of interest, we found "The Nature of Culture," by E. Adamson Hoebel, "The Growth of Culture," by Ruth Benedict (edited by Margaret Mead), and "Language and Writing," by Harry Hoijer, of particular interest.

We keep repeating in these reviews that, while integrative education requires us to encompass conceptually all of our myriad modern special "ologies," we are in danger of making grievous errors if our concepts regarding human nature and the cultural aspects of that nature are not in clear focus. To this reviewer, at least, anthropology and psychology must be studied in parallel. We recommend this book because of its value in helping us focus on this parallelism.

"In any appraisal of human biology," Dr. Shapiro writes in the opening chapter, "Human Beginnings," "one factor emerges as unique. This is the effect of human culture on man's biological development. No other creature has created for himself anything like it. In a sense it is a new dimension—a new environment a niche —to which mankind while creating it must also adapt itself."

—*Harvey W. Culp*

"The superior discipline of science which brought it within a unitary picture embracing the whole, was metaphysics. Metaphysics was science insofar as it collated the certified results of the separate disciplines. The results served as material for metaphysics to create a world-image, a thing individual sciences are neither in a position to sketch out, nor interested in sketching out. In aggregating and interpreting the material to form a world-image, metaphysics is philosophy. But it is more than that, for it supports itself not on the scientifically certified material of consciousness alone, but has to embrace also all that had its basis in man's aboriginal experience and bears the character of inward certainty. It accordingly takes up the mythical and religious elements of unconscious feelings and imagination, and includes these in its picture of the world. In that way it draws near to theology, and coalesces with it when theology is not stiff with dogmatism, but has it roots in vital religious experience. Metaphysics therefore bases its world-image upon a power lying beyond all conscious experience and properly regarded as the Prime Cause and Final Ground."

—From *Man in This World* by Hans Zehrer, New York University Press, 1955, pp. 214-215.